

REMARKS

Claims 1, 3, 5-10 and 23 are pending in this application. By this Amendment, claims 1 and 9 are amended, and claim 24 is canceled. Support for the amendments to claims 1 and 9 can be found, for example, a page 20, lines 23-24, and page 21, lines 17-24 of the originally filed specification. No new matter is added.

Entry of the amendments is proper under 37 CFR §1.116 because the amendments: (a) place the application in condition for allowance for the reasons discussed herein; (b) do not raise any new issue requiring further search and/or consideration as the amendments amplify issues previously discussed throughout prosecution; (c) do not present any additional claims without canceling a corresponding number of finally rejected claims; and (d) place the application in better form for appeal, should an appeal be necessary. The amendments are necessary and were not earlier presented because they are made in response to arguments raised in the final rejection. Entry of the amendments is thus respectfully requested.

In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

I. Claim Objections

The Office Action objects to claim 1 for minor informalities. By this Amendment, claim 1 is amended to incorporate the Examiner's helpful suggestions. Accordingly, reconsideration and withdrawal of the objection are respectfully requested.

II. Rejections Under 35 U.S.C. §103

A. Oshima in view of Du Rose

The Office Action rejects claims 1, 3 and 5-8 under 35 U.S.C. §103(a) as being unpatentable over JP-A-2002-212775 to Oshima ("Oshima") in view of U.S. Patent No. 3,183,067 to Du Rose et al. ("Du Rose"). Applicants respectfully traverse the rejection.

By this Amendment, claim 1 is amended to delete the term "optional additives," and recite "a semi-brightener." Oshima and Du Rose, alone or in combination, do not teach or suggest at least this claimed feature. Moreover, one of ordinary skill in the art would have had no reason or rationale to have developed the method of claim 1 from the disclosures of Oshima and Du Rose. Thus, claim 1 would not have been rendered obvious by Oshima and Du Rose for at least this reason.

Furthermore, the method of claim 1 provides unexpected results over the applied references. Thus, claim 1 also would not have been rendered obvious by Oshima and Du Rose for at least this additional reason.

Claim 1 is directed to a method of manufacturing a rare-earth magnet, where the first plating bath has "a concentration of the nickel source of 0.3 mol/l to 0.7 mol/l on a nickel atom basis and a conductivity of 80 mS/cm or over." These are critical ranges that unexpectedly improve the corrosion resistance of a rare-earth magnet by preventing the rare-earth-rich phase from leaching out and reducing the production of pinholes.

The Experimental Examples shown in the attached table further describe the unexpected results. The first three examples provide a first plating bath and a second plating bath where the concentration of the nickel source is 0.3 mol/l to 0.7 mol/l on a nickel atom basis and the conductivity is 80 mS/cm or over, as claimed. The first three examples of the rare-earth magnets passed the high-temperature high-humidity test and the salt spray test.

On the other hand, examples 7-10, all of which fell outside of the claimed range of the nickel concentration and/or the conductivity failed the high-temperature high-humidity test and the salt spray test, and showed plating film bulge, plating film peeling or corrosion. For example, Example 4 provides a nickel chloride concentration of 0.27 mol/l, and a conductivity of 182 mS/cm in the first plating bath and 0.27 mol/l and a conductivity of 181 mS/cm in the second plating bath. This example is below the claimed nickel concentration by

only 0.03 mol/l in each plating bath. Under the high temperature high humidity test, Example 4 showed plating film bulge, and under the salt spray test, Example 4 showed plating film peeling. See attached table at Example 4. Thus, even when the nickel concentration is decreased by as little as 0.03 mol/l, the method of manufacture provided undesirable properties.

Moreover, Example 7 provides a nickel concentration of 0.7 mol/l in both the first and second plating baths, but a conductivity of only 78 mS/cm in each plating bath. Example 7 failed the high temperature high humidity test, by showing corrosion, and failed the salt spray test, by showing plating film bulge. As the example indicates, even a drop of only 2 mS/cm in conductivity allowed Example 7 to fail both tests.

Thus, the claimed concentration and conductivity ranges are critical ranges that unexpectedly improve the corrosion resistance in the method of manufacturing a rare-earth magnet.

These results show that even if the protective film is formed by electroplating with the use of a plating bath having a nickel source concentration near the claimed range of 0.3 mol/l to 0.7 mol/l, or having a conductivity slightly less than the claimed 80 mS/cm, many pinholes are produced and the examples fail the high temperature high humidity test and salt spray test.

As discussed in the present specification, when the nickel source concentration is higher than 0.7 mol/l, a local cell is configured between the rare-earth-rich phase and the boron-rich phase as the rare-earth magnet body is dipped into the plating solution.

Additionally, because there is a difference in oxidation-reduction potential between a rare-earth metal and nickel, the rare-earth metal included in the rare-earth-rich phase is oxidized by a rare-earth ion and a nickel ion in the plating solution and is thus reduced to a metal nickel.

Accordingly, oxidation (i.e. corrosion) of the rare-earth-rich phase and an immersion plating, due to the leaching of the rare-earth-rich phase and precipitation of nickel, are produced. Thereby, a base of corrosion in the rare-earth-rich phase is produced. Since such corrosion of the rare-earth-rich phase increases surface roughness of the magnet body, it becomes difficult to well cover the surface of the magnet body by the protective film (the plating film), and thus, many pinholes are produced.

Moreover, when the nickel source concentration is lower than 0.3 mol/l, electrolysis of water occurs during the electroplating process. In place of nickel plating, hydrogen gas is produced. As a result, many pinholes are produced in the plating film. Such generation of hydrogen gas makes it difficult to carry out industrially appropriate production. See e.g. specification at page 13, lines 14-23.

Furthermore, even when the nickel source concentration is within the range of 0.3 mol/l to 0.7 mol/l, the conductivity is critical. When the conductivity is lower than 80 mS/cm, an effect of slowing immersion plating cannot be sufficiently obtained. See e.g. specification at page 14, lines 17-21. In addition, because throwing power is lowered, it becomes difficult to well cover the surface of the magnetic body by the plating film, and thus, many pinholes are produced.

Based on the experimental results, in the method of manufacturing the rare-earth magnet of the present application, it is apparent that using the claimed nickel source concentrations and the claimed conductivity range are critical in reducing the amount of pinholes produced in the protective film. Furthermore, these claimed ranges prevent the leaching of the rare-earth-rich phase and also allow improved corrosion resistance.

Based on these results, it is evident that a nickel source concentration of 0.3 mol/l to 0.7 mol/l, and a conductivity of 80 mS/cm or over, as claimed, is critical in achieving unexpected results.

Consequently, claim 1 would not have been rendered obvious by Oshima and Du Rose, alone or in combination. Oshima and Du Rose do not teach or suggest each and every feature of claim 1, and the claimed nickel source concentration and the claimed conductivity ranges recited in claim 1 provide unexpected results over Oshima and Du Rose. As a result, claim 1 would not have been rendered obvious by Oshima and Du Rose. Claims 3 and 5-8 depend from claim 1 and, thus, also would not have been rendered obvious by Oshima and Du Rose. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

B. Oshima in view of Du Rose and Martin

The Office Action rejects claims 9 and 10 under 35 U.S.C. §103(a) as being unpatentable over Oshima, in view of Du Rose and U.S. Patent No. 2,986,501 to Martin ("Martin"). Applicants respectfully traverse the rejection.

Claim 9 is directed to a method of manufacturing a rare-earth magnet "the first plating bath consisting of 0.3 mol/l to 0.7 mol/l of nickel ions...and having a conductivity of 80 mS/cm or over." As discussed above, the attached table shows the unexpected results of a first plating having 0.3 mol/l to 0.7 mol/l of nickel, and having a conductivity of 80 mS/cm or over, as claimed. Thus, claim 9 would not have been rendered obvious by Oshima and Du Rose.

Martin does not provide a nickel concentration or conductivity within the range of claim 9, and one of ordinary skill in the art would have had no reason or rationale to have developed the method of claim 9 from the cited references. Thus, claim 9 would not have been rendered obvious over Oshima, Du Rose and Martin. Claim 10 depends from claim 9 and, thus, also would not have been rendered obvious by Oshima, Du Rose and Martin. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

C. Oshima, Du Rose and Di Bari

The Office Action rejects claim 23 under 35 U.S.C. §103(a) as being unpatentable over Oshima, in combination with Du Rose and in further view of "Nickel Electroplating" by Di Bari ("Di Bari"). Applicants respectfully traverse the rejection.

As discussed above, by this Amendment, claim 1 is amended to delete the term "optional additives," and recite "a semi-brightener." Furthermore, the claimed nickel source concentration and conductivity ranges of claim 1 produces unexpected results over Oshima and Du Rose. As a result, claim 1 would not have been rendered obvious by Oshima and Du Rose. Di Bari fails to cure these deficiencies. Di Bari does not provide any reason or rationale for one of ordinary skill in the art to have developed the method of claim 1 from the cited references. Claim 23 depends from claim 1 and, thus, also would not have been rendered obvious by Oshima, Du Rose and Di Bari. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

D. Oshima in combination with Du Rose and Martin in view of Di Bari

The Office Action rejects claim 24 under 35 U.S.C. §103(a) as being unpatentable over Oshima, in combination with Du Rose and Martin and in further view of Di Bari ("Di Bari"). By this Amendment, claim 24 is canceled, rendering the rejection moot.

E. Oshima in combination with JP '930

The Office Action rejects claims 1, 3, 5-8 and 23 under 35 U.S.C. §103(a) as being unpatentable over Oshima, in combination with JP-50-118930 ('930). Applicants respectfully traverse the rejection.

The Office Action asserts that JP '930 teaches a nickel source concentration of 0.201 mol/l, and that it would have been obvious to modify the concentration of JP '930 to practice the claimed invention. However, as discussed above, the ranges of claim 1 are critical ranges that provide unexpected results over the applied references. As the attached table shows,

even a drop in concentration of only 0.03 mol/l caused example 4 to fail both the high temperature high humidity test and the salt spray test. Thus, the claimed range is a critical range that provides unexpected results over the applied references, and neither the range nor its unexpected results are taught or suggested by the cited references.

As a result, claim 1 would not have been rendered obvious by Oshima and JP '930. Claims 3, 5-8 and 23 depend from claim 1 and, thus, also would not have been rendered obvious by Oshima and JP '930. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

F. Oshima in combination with JP '930 and Di Bari

The Office Action rejects claims 9-10 and 24 under 35 U.S.C. §103(a) as being unpatentable over Oshima, in combination with JP-50-118930 ('930) and Di Bari. By this Amendment, claim 24 is canceled, rendering the rejection moot. As to the remaining claims, Applicants respectfully traverse the rejection.

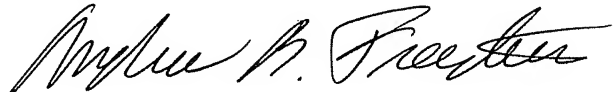
As discussed above, the claimed ranges of claim 9 provide unexpected results over Oshima and JP '930. Di Bari fails to cure these deficiencies. Thus, claim 9 would not have been rendered obvious by Oshima, JP '930 and Di Bari. Claim 10 depends from claim 9 and, thus, also would not have been rendered obvious by Oshima, JP '930 and Di Bari. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

III. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of the application are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,



James A. Oliff
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JAO:ABF/pjw

Attachments:

Table

Petition for Extension of Time

Date: July 28, 2008

OLIFF & BERRIDGE, PLC
P.O. Box 320850
Alexandria, Virginia 22320-4850
Telephone: (703) 836-6400

<p>DEPOSIT ACCOUNT USE AUTHORIZATION Please grant any extension necessary for entry; Charge any fee due to our Deposit Account No. 15-0461</p>
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(Table)

	FIRST PLATING BATH		SECOND PLATING BATH		HIGH-TEMPERATURE HIGH-HUMIDITY TEST	SALT SPRAY TEST
	COMPOSITION	CONDUCTIVITY mS/cm	COMPOSITION	CONDUCTIVITY mS/cm		
EXPERIMENTAL EXAMPLE 1	NICKEL SULFATE 0.7 M LITHIUM CHLORIDE 0.5 M BORIC ACID 0.5 M SEMI-BRIGHTENER ADEQUATE AMOUNT	82	NICKEL SULFATE 0.7 M LITHIUM CHLORIDE 0.5 M BORIC ACID 0.5 M BRIGHTENER ADEQUATE AMOUNT	82	PASS	PASS
EXPERIMENTAL EXAMPLE 2	NICKEL SULFATE 0.3 M POTASSIUM CHLORIDE 1.0 M BORIC ACID 0.7 M SEMI-BRIGHTENER ADEQUATE AMOUNT	88	NICKEL SULFATE 0.3 M POTASSIUM CHLORIDE 1.0 M BORIC ACID 0.7 M BRIGHTENER ADEQUATE AMOUNT	88	PASS	PASS
EXPERIMENTAL EXAMPLE 3	NICKEL SULFATE 0.7 M AMMONIUM CHLORIDE 0.5 M BORIC ACID 0.5 M SEMI-BRIGHTENER ADEQUATE AMOUNT	82	NICKEL SULFATE 0.7 M AMMONIUM CHLORIDE 0.5 M BORIC ACID 0.5 M BRIGHTENER ADEQUATE AMOUNT	82	PASS	PASS
EXPERIMENTAL EXAMPLE 4	NICKEL CHLORIDE 0.27 M POTASSIUM CHLORIDE 1.5 M BORIC ACID 1.0 M SEMI-BRIGHTENER ADEQUATE AMOUNT	182	NICKEL CHLORIDE 0.27 M POTASSIUM CHLORIDE 1.5 M BORIC ACID 1.0 M BRIGHTENER ADEQUATE AMOUNT	181	PLATING FILM BULGE	PLATING FILM PEELING
EXPERIMENTAL EXAMPLE 5	NICKEL SULFATE 0.27 M LITHIUM CHLORIDE 1.0 M BORIC ACID 0.7 M SEMI-BRIGHTENER ADEQUATE AMOUNT	86	NICKEL SULFATE 0.27 M LITHIUM CHLORIDE 1.0 M BORIC ACID 0.7 M BRIGHTENER ADEQUATE AMOUNT	86	PLATING FILM BULGE	PLATING FILM PEELING
EXPERIMENTAL EXAMPLE 6	NICKEL BROMIDE 0.27 M AMMONIUM SULFATE 0.4 M BORIC ACID 1.6 M SEMI-BRIGHTENER ADEQUATE AMOUNT	75	NICKEL BROMIDE 0.27 M AMMONIUM SULFATE 0.4 M BORIC ACID 1.6 M BRIGHTENER ADEQUATE AMOUNT	75	PLATING FILM BULGE	PLATING FILM PEELING
EXPERIMENTAL EXAMPLE 7	NICKEL SULFATE 0.7 M LITHIUM CHLORIDE 1.0 M BORIC ACID 0.45 M SEMI-BRIGHTENER ADEQUATE AMOUNT	78	NICKEL SULFATE 0.7 M LITHIUM CHLORIDE 1.0 M BORIC ACID 0.45 M BRIGHTENER ADEQUATE AMOUNT	78	CORROSION OBSERVED	PLATING FILM BULGE
EXPERIMENTAL EXAMPLE 8	NICKEL SULFATE 0.75 M POTASSIUM BROMIDE 1.0 M BORIC ACID 0.7 M SEMI-BRIGHTENER ADEQUATE AMOUNT	88	NICKEL SULFATE 0.75 M POTASSIUM BROMIDE 1.0 M BORIC ACID 0.7 M BRIGHTENER ADEQUATE AMOUNT	88	CORROSION OBSERVED	CORROSION OBSERVED
EXPERIMENTAL EXAMPLE 9	NICKEL CHLORIDE 0.75 M LITHIUM CHLORIDE 1.3 M BORIC ACID 0.7 M SEMI-BRIGHTENER ADEQUATE AMOUNT	132	NICKEL CHLORIDE 0.75 M LITHIUM CHLORIDE 1.3 M BORIC ACID 0.7 M BRIGHTENER ADEQUATE AMOUNT	132	CORROSION OBSERVED	CORROSION OBSERVED
EXPERIMENTAL EXAMPLE 10	NICKEL BROMIDE 0.27 M AMMONIUM SULFATE 0.4 M BORIC ACID 1.6 M SEMI-BRIGHTENER ADEQUATE AMOUNT	75	NICKEL BROMIDE 0.27 M AMMONIUM SULFATE 0.4 M BORIC ACID 1.6 M BRIGHTENER ADEQUATE AMOUNT	75	PLATING FILM BULGE	PLATING FILM PEELING